AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) Method for automating the design of a ducting system for a fluid comprising the steps of entering boundary data (15, 17, 19, 20) identifying boundary conditions of the ducting system, into a data processing system, <u>determining design data (27, 43) by applying an optimization algorithm to said boundary data using said data processing system, which design data comprises an optimum layout (27) of said ducting system in the three dimensional installation space, and having said data processing system communicate the design data (27, 43) to an external recipient, wherein the</u> ~~which~~ boundary data comprises positional information (17) in a three dimensional installation space and magnitude of partial fluid flow (19, 20) for each of at least one component terminal connection, through which fluid is exchanged with the ducting system, wherein the fluid flow through said at least one component

terminal connection has a common orientation, and positional information (15) in the three dimensional installation space of at least one main terminal connection, through which the total fluid flowing through the at least one component terminal connection is routed, ~~determining design data (27, 43) by applying an optimization algorithm to said boundary data using said data processing system, which design data comprises an optimum layout (27) of said ducting system in the three dimensional installation space~~ said optimum layout including an identification of all required ducting components (43) for building the ducting system, selected from a collection of standard ductwork primitives (51)~~, and having said data processing system communicate the design data (27, 43) to an external recipient~~.

2. (Original) Method for automating the design of a ducting system according to claim 1, wherein said boundary data contains a uniform fluid velocity value (13) corresponding to a uniform desired flow speed of the fluid in all parts of the ducting system.

3. (Currently amended) Method for automating the design of a

ducting system according to claim 1 ~~or 2~~, wherein said boundary data contains information determining said common orientation of the fluid flow through said at least one component terminal connection.

4. (Currently amended) Method for automating the design of a ducting system according to claim 1 ~~any of claims 1 to 3~~, wherein a required throughput capacity of at least one pipe element (41), which is contained in said required ducting components (43), is calculated by the data processing means considering the position of the pipe element (41) within said optimum layout (27) of the ducting system and the magnitude of said partial fluid flow (19,20) for each of the at least one component terminal connection, while a uniform ~~desired~~ flow speed of the fluid in all parts of the ducting system is present ~~assumed~~.

5. (Currently amended) Method for automating the design of a ducting system according to claim 1 ~~any of claims 1 to 4~~, wherein said boundary data (15, 17, 19, 20) contains information identifying a z-dimension (12), corresponding to the height of a trunk plane above the floor level of the

three dimensional installation space, which floor level is defined by the x- and y- axes of the coordinate system and in which trunk plane a trunk pipe system (26) is configured, which provides connections to one main terminal location (15) and at least one drop (17), which is the location defined by the projection of the at least one component terminal connection along the z-axis into the trunk plane.

6. (Original) Method for automating the design of a ducting system according to claim 5, wherein said optimum layout (27) of said ducting system is determined by optimizing the configuration of said trunk pipe system (26), which contains at least one straight trunk pipe (28), wherein the orientations allowed for said at least one straight trunk pipe (28) are restricted to the directions of the x- and the y-axis of the coordinate system.

7. (Currently amended) Method for automating the design of a ducting system according to claim 5 ~~or 6~~, wherein said optimization algorithm to determine said optimum layout (27) of said trunk pipe system (26) comprises the steps of:

dividing said drops (17) into two drop groups (29, 30)

according to the location of drops (17) relative to said main terminal location (15 in x-direction,

dividing each drop group (29, 30) into two side groups (31, 32) according to the location of drops (17) within said drop groups (29, 30) relative to said main terminal location (15) in y-direction,

applying a subdividing routine for subdividing input groups into at least one output group to each side group (31, 32), while the output group is named level 1 group (33), by assigning each drop (17) separated from any other drop (17) within the same input group by a distance of equal or less than a predetermined parameter to individual output groups,

determining a group center coordinate (34) for each output group by averaging the coordinates of said drops (17) contained in said output group,

iteratively applying said subdividing routine to said at least one output group of the respective prior routine, as long as a pair of drops (17) separated by a distance of equal or less than a respective parameter

value, which is supplied from a list of predetermined parameters of decreasing value, exists,

obtaining a layout A of said trunk pipe system (26) by applying a routine for laying out the pipelines comprising the steps of laying out horizontal pipelines (35) originating from said main terminal location (15) in both directions, providing branching points (36) to vertical pipelines (37), connecting said at least one level 1 group (33) to said trunk pipe system (26), while said vertical pipelines (37) are positioned in ~~is~~ such a way, that their pathways include said group center coordinate (34) of said respective level 1 group (33), and adding orthogonal pipelines to said vertical pipelines (37), connecting the single drops (17) to said trunk pipe system (26) either directly or via branching points (36) of further group level distribution systems, providing access to the remaining drops via a grid of orthogonal pipelines, while the pathways of said orthogonal pipelines include said group center coordinates of the remaining groups,

selecting said optimum layout (27) of the trunk pipe

system (26) by choosing the layout providing the shorter total length of all pipeline segments between said layout A of said trunk pipe system (26) and layout B obtained by rotating the design area (14) by 90 degrees, configuring the pipes according to said routine for laying out the pipelines, and rotating the design area (14) back by 90 degrees.

8. (Currently amended) Method for automating the design of a ducting system according to claim 1 ~~any of claims 1 to 7~~, wherein said method contains the step of modifying any aspect of said design data (27, 43) through a user interface, if needed, after said design data is determined by the data processing system.

9. (Currently amended) Method for automating the design of a ducting system according to claim 1 ~~any of claims 1 to 8~~, wherein said step of having the data processing system communicate the design data (27, 43) to an external recipient results in a visual display of the geometry of said optimum layout (27) to scale to the physical layout of the desired ducting system including visualizations of said at least one

component terminal connection, of said at least one main terminal connection, of at least one elbow device (40) if required by the layout, each of which is interfacing a pair of pipe elements (41) of different orientations, which pipe elements (43) are contained in said required ducting components (45), and of at least one branching device (39) if required by the layout, each of which is connecting at least three [[3]] pipe elements (41).

10. (Original) Method for automating the design of a ducting system according to claim 9, wherein said step of having the data processing system communicate the design data (27, 43) to an external recipient results in the visual display of a list (43) of said required ducting components including their prices (50), which list is based on said visual display of the optimum layout (27).

11. (Currently amended) Method for automating the design of a ducting system according to claim 1 ~~any of claims 1 to 10~~, wherein said method can be utilized via the Internet through the use of web browsing software.

12. (Currently amended) Means for automating the design of a ducting system for a fluid comprising data entry means, data processing means applying optimization criteria in order to determine design data (27, 43) comprising an optimum layout (27) of said ducting system in the three dimensional installation space, and data output means, communicating said design data (27, 43) to an external recipient, wherein said data entry means are used to identify positional information (17) in a three dimensional installation space and magnitude of partial fluid flow (19, 20) for each of at least one component terminal connection, through which fluid is exchanged with the ducting system, wherein the fluid flow through said at least one component terminal connection has a common orientation, and positional information (15) in the three dimensional installation space of at least one main terminal connection, through which the total fluid flowing through the at least one component terminal connection is routed, the means for automating the design of a ducting system for a fluid further comprises a standard ductwork data base (51) containing a collection of standard ductwork primitives, ~~data processing means applying optimization criteria in order to determine design data (27, 43),~~

~~comprising an~~ said optimum layout (27) ~~of said ducting system in the three dimensional installation space~~ including an identification of all required ducting components (43) for building the ducting system, selected from a collection of standard ductwork primitives (51)~~, and data output means, communicating said design data (27, 43) to an external recipient~~.

13. (Original) Means for automating the design of a ducting system according to claim 12, wherein said data entry means are used to identify a uniform fluid velocity value (13) corresponding to a uniform desired flow speed of the fluid in all parts of the ducting system.

14. (Currently amended) Means for automating the design of a ducting system according to claim 12 ~~or 13~~, wherein said data entry means are used to identify said common orientation of the fluid flow through said at least one component terminal connection.

15. (Currently amended) Means for automating the design of a ducting system according to claim 12 ~~any of claims 12 to 14~~,

wherein a required throughput capacity of at least one pipe element (41), which is contained in said required ducting components (43), is calculated by the data processing means considering the position of the pipe element (41) within said optimum layout (27) of the ducting system, the magnitude of said partial fluid flow (19,20) for each of the at least one component terminal connection, while a uniform ~~desired~~ flow speed of the fluid in all parts of the ducting system is present ~~assumed~~.

16. (Currently amended) Means for automating the design of a ducting system according to claim 12 ~~any of claims 12 to 15~~, wherein said data entry means are used to identify a z-dimension (12), corresponding to the height of a trunk plane above the floor level of the three dimensional installation space, which floor level is defined by the x- and y- axes of the coordinate system and in which trunk plane a trunk pipe system (26) is configured, which provides connections to one main terminal location (15) and at least one drop (17), which is the location defined by the projection of the at least one component terminal connection along the z-axis into the trunk plane.

17. (Original) Means for automating the design of a ducting system according to claim 16, wherein said data processing means determine said optimum layout (27) of said ducting system by optimizing the configuration of said trunk pipe system (26), which contains at least one straight trunk pipe (28), wherein the orientations allowed for said at least one straight trunk pipe (28) are restricted to the directions of the x- and the y-axis of the coordinate system.

18. (Currently amended) Means for automating the design of a ducting system according to claim 16 ~~or 17~~, wherein said optimization criteria used to determine said optimum layout (27) of said trunk pipe system (26) are based on an algorithm comprising the steps of:

dividing said drops (17) into two drop groups (29, 30) according to the location of drops (17) relative to said main terminal location (15 in x-direction,

dividing each drop group (29, 30) into two side groups (31, 32) according to the location of drops (17) within said drop groups (29, 30) relative to said main

terminal location (15) in y-direction,

applying a subdividing routine for subdividing input groups into at least one output group to each side group (31, 32), while the output group is named level 1 group (33), by assigning each drop (17) separated from any other drop (17) within the same input group by a distance of equal or less than a predetermined parameter to individual output groups,

determining a group center coordinate (34) for each output group by averaging the coordinates of said drops (17) contained in said output group,

iteratively applying said subdividing routine to said at least one output group of the respective prior routine, as long as a pair of drops (17) separated by a distance of equal or less than a respective parameter value, which is supplied from a list of predetermined parameters of decreasing value, exists,

obtaining a layout A of said trunk pipe system (26) by applying a routine for laying out the pipelines comprising the steps of laying out horizontal pipelines

(35) originating from said main terminal location (15) in both directions, providing branching points (36) to vertical pipelines (37), connecting said at least one level 1 group (33) to said trunk pipe system (26), while said vertical pipelines (37) are positioned in ~~is~~ such a way, that their pathways include said group center coordinate (34) of said respective level 1 group (33), and adding orthogonal pipelines to said vertical pipelines (37), connecting the single drops (17) to said trunk pipe system (26) either directly or via branching points (36) of further group level distribution systems, providing access to the remaining drops via a grid of orthogonal pipelines, while the pathways of said orthogonal pipelines include said group center coordinates of the remaining groups,

selecting said optimum layout (27) of the trunk pipe system (26) by choosing the layout providing the shorter total length of all pipeline segments between said layout A of said trunk pipe system (26) and layout B obtained by rotating the design area (14) by 90 degrees, configuring the pipes according to said routine for laying out the pipelines, and rotating the

design area (14) back by 90 degrees.

19. (Currently amended) Means for automating the design of a ducting system according to claim 12 ~~any of claims 12 to 18~~, wherein said means comprise a user interface, used to modify any aspect of said design data (27, 43), if needed.

20. (Currently amended) Means for automating the design of a ducting system according to claim 12 ~~any of claims 12 to 19~~, wherein said data output means visually display the geometry of said optimum layout (27) to scale to the physical layout of the desired ducting system including visualizations of said at least one component terminal connection, of said at least one main terminal connection, of at least one elbow device (40) if required by the layout, each of which is interfacing a pair of pipe elements (41) of different orientations, which pipe elements (41) are contained in said required ducting components (43), and of at least one branching device (39) if required by the layout, each of which is connecting at least three [[3]] pipe elements (41).

21. (Original) Means for automating the design of a ducting

system according to claim 20, wherein said data output means visually display of a list (43) of said required ducting components including their prices (50), which list is based on said visual display of the optimum layout (27).

22. (Currently amended) Means for automating the design of a ducting system according to <u>claim 12</u> ~~any of claims 12 to 21~~, wherein said means can be utilized via the Internet through the use of web browsing software.